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DATE MAILED: 06/30/95

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☐ This application has been examined ☑ Responsive to communication filed on 3/27/95 ☑ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), 0 days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☑ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474..
6. ☐ _____.

Part II SUMMARY OF ACTION

1. ☑ Claims 82 - 151 are pending in the application.

   Of the above claims _____ are withdrawn from consideration.

2. ☑ Claims 1 - 81 have been cancelled.

3. ☐ Claims _____ are allowed.

4. ☑ Claims 82-151 are rejected.

5. ☐ Claims _____ are objected to.

6. ☐ Claims _____ are subject to restriction or election requirement.

7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.

8. ☐ Formal drawings are required in response to this Office action.

9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).

10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____. has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).

11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).

12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____.

13. ☐ Since this application apppears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.

14. ☐ Other

EXAMINER'S ACTION

1. The following correspondence is in response to the amendment submitted on 3-27-95.

2. The double-patenting rejection is withdrawn in view of the terminal disclaimer submitted on 3-31-95.

As to the prior art rejections, the arguments presented in the 3-27-95 response are moot in view of the new grounds of rejection made in response to the new limitations added to the claims.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Claims 82-95, 102-111, 114-128, 135-144 and 147-150 are rejected under 35 U.S.C. § 103 as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130, Giger et al. 5,133,020 and Doi et al. 4,851,984. As an alternative grounds of rejection, the above mentioned claims are rejected as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130 and Alverez et al. 4,029,963.

As to claim 82, Doenges teaches a method for detecting a specific given material that may be present in an ensemble of objects, including the steps of exposing regions of the ensemble to dual energy x-rays from source (1a), and measuring the dual energy x-ray intensity which passes through the ensemble and impinges on linear detector (col. 2, line 30). The specific materials in the ensemble are determined by taking a ratio of the dual energy x-ray data transmitted through the ensemble (col. 2, lines 43-48). The presence of given materials are determined by reference to a look-up table (col. 3, lines 52-55). The presence of given materials are illustrated by highlighting the structures on a video display (11b, 11a, col. 3, lines 52-67).

Claim 82 specifically recites that the property of the suspect material is determined by removing "contribution of overlying and underlying material". Examiner submits that, because different materials absorb the dual energy x-rays in different capacities, Doenges implicitly removes the effects of overlying and underlying materials in his processing. However,

more to the point is Macovski, which shows separating overlapping materials Z1, Z2 and Z3 in an ensemble (27, 28) by using multi-energy x-rays and a look-up table (cols. 6-7). It would have been obvious to separate materials in the manner taught by Macovski in order to better highlight dangerous materials which are obfuscated by underlying or overlying materials.

New claim 82 adds the limitation that the overlying and underlying materials are removed by performing a calculation which is a function of "rays passing through said target object of said specific material of interest as well as rays passing near but not through said target object". This broadly refers to, for example, equation (3) on page 21 of the specification, where the background values are subtracted from the target region values before taking a ratio of high and low energy x-rays. As discussed in the 3-15-95 interview, Macovscki and Doenges do not perform such a background correction step. However, a follow-up search indicates that this feature, as so broadly claimed, does not render the claims patentable. For instance, Giger teaches processing an x-ray image to remove background image data to improve analysis of a target region (e.g. a lesion, see col. 10, line 50 to col. 11, line 32). This process consists of taking samples of pixels in both the target region (col. 10, lines 50-57) and the background region (col. 10, lines 57-68). Doi '984 supplements Giger by expressly stating that this background correction may consist of *subtracting* the background trend from

the target region (col. 6, lines 41-56). It would have been obvious to remove the background overlying or underlying data from the images produced by Doenges/Macovski in order to improve materials identification by filtering off the effects of obscuring images.

As an alternative grounds of rejection, Alverez teaches the use of dual-energy scanning to construct a three-dimensional view of the internal structure of an object by conventional tomographic reconstruction techniques (col. 5, lines 21-42). This technique can be used to remove overlying or underlying regions (col. 9, lines 29-54). Because x-rays are passed through the object at a plurality of different angles, the final computation of the output image is inherently derived from rays which pass through the target region and background region, and rays which pass only through the background region. Claim 82 calls for "stationary" x-ray exposure and detection systems, but the system of Alverez is stationary in the sense that the overall system is fixed in place. It would have been obvious to expand the materials identification techniques of Doenges and Macovski to 3-D tomographic reconstruction in order to better isolate the target region from its surroundings.

As to claim 83, Giger, Doi and Alverez all employ image data taken from different regions of the target object to produce the final output display.

As to claim 84, Doenges uses an x-ray fan-beam source (col. 2, line 16).

As to claim 85, Doenges and Macovski use dual energy sources.

As to claim 86, Doenges uses an x-ray fan-beam source (col. 2, line 16).

As to claim 87, Doenges is concerned with detecting objects in luggage.

As to claim 88, Doenges uses a linear detector (col. 2, line 30).

As to claims 89-90, Macovski calculates a Z value of the material, which is representative of its physical characteristics.

As to claims 91-92, Doenges detects explosives and drugs, contrasted with harmless objects.

As to claim 93, Giger teaches deleting the underlying region by sampling a background subarea (e.g. of the periphery of the image). Alverez teaches deleting underlying regions by scanning the object at a plurality of angles, which implicitly includes various background and nearby target regions. See discussion given for claim 82 for an expanded discussion of Giger and Alverez.

As to claim 94, Doenges and Macovski use dual energy sources.

As to claim 95, Doenges is intended for use in detecting bombs.

As to claim 102, Doenges highlights on a video display (col. 3).

As to claims 103 and 106-107, dilation and erosion algorithms are old and well known in the image processing art, and examiner makes official notice of such. It would have been obvious to use these techniques in Doenges to improve detection of suspect target objects. Note that Giger in col. 10 performs region growing which may be construed as dilation.

As to claim 104, Doenges highlights on a video display (col. 3).

As to claim 105, Doenges highlights suspect objects, which may be construed as an alarm.

As to claims 108-109, both Doenges and Macovski use look-up tables. Furthermore, in Macovski the parameters in the look-up table can be empirically determined with test objects (col. 6, line 63). It is old and well known to perform such empirical testing at a variety of thicknesses (col. 7 of Alverez, 4,029,963, for example).

As to claim 110, conventional dual-energy x-ray imaging involves computation of the logarithms of the attenuation data, and examiner makes Official Notice of such. Also note discussion of Giger given for claim 82 for "subtracting" feature.

As to claim 111, Doenges switches between two different energy levels (col. 2, lines 24-28).

As to claim 114, using image gradients to identify boundaries in an image is old and well known in the art, and examiner makes official notice of such. Note col. 10 of Giger.

Claims 115-128, 135-144 and 147 substantially repeat the same limitations as the above identified claims, and are therefore rejected for the reasons given above.

As to claims 148-150, it is common practice to take potentially dangerous explosive devices and analyze them further with more sophisticated measurements means. It is therefore not a patentable distinction to broadly claim automated means for passing information from a first device to a second (e.g. over a network) to perform further analysis.

4. Claims 96-101, 129-134 and 151 are rejected under 35 U.S.C. § 103 as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130, Giger et al. 5,133,020 and Doi et al. 4,851,984 (as applied above), and further in view of Cumings (reference S of 10-11-94 1449 statement). As an alternative grounds of rejection, the above mentioned claims are rejected as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130 and Alverez et al. 4,029,963 (as applied above), and further in view of Cumings.

As to the further limitations of claims 96-101, Cumings teaches the use of a CT scanner to detect explosives in parcels

(see page 121). It would have been obvious to supplement the single scans of Doenges with a CT scanner to provide more detailed information on potential explosives in luggage.

Claims 129-134 and 151 substantially repeat the same limitations as the above identified claims, and are therefore rejected for the reasons given above.

5. Claims 112 and 145 are rejected under 35 U.S.C. § 103 as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130, Giger et al. 5,133,020 and Doi et al. 4,851,984 (as applied above), and further in view of Brooks 4,247,774. As an alternative grounds of rejection, the above mentioned claims are rejected as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130 and Alverez et al. 4,029,963 (as applied above), and further in view of Brooks 4,247,774.

As to the further limitations of claim 112, Brooks teaches the generation of multi-energy x-rays which are simultaneously detected by high and low energy detectors (figure 1). It would have been obvious to use a multi-energy x-ray source in Doenges in order to improve the speed at which the luggage was scanned.

Claim 145 substantially repeats the same limitations as the above identified claim, and is therefore rejected for the reasons given above.

6. Claims 113 and 146 are rejected under 35 U.S.C. § 103 as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130, Giger et al. 5,133,020 and Doi et al. 4,851,984 (as

applied above), and further in view of Griesmer et al. 4,748,649. As an alternative grounds of rejection, the above mentioned claims are rejected as being unpatentable over Doenges 4,987,584 in view of Macovski 3,848,130 and Alverez et al. 4,029,963 (as applied above), and further in view of Griesmer et al. 4,748,649.

As to the further limitations of claim 113, compensation for the dark current in an x-ray detection device is old and well known in the art, as exemplified by col. 9, lines 10-16 of Griesmer. It would have been obvious to employ this technique in Doenges to improve the quality of the resultant image.

Claim 146 substantially repeats the same limitations as the above identified claim, and is therefore rejected for the reasons given above.

7. The cited but not applied art is considered relevant to applicant's disclosure. Kawamoto et al. teaches dilation and erosion in image processing. Shatzki teaches performing gradient analysis on images of luggage to detect contraband.

8. Applicant's amendment necessitated the new grounds of rejection. Accordingly, **THIS ACTION IS MADE FINAL**. See M.P.E.P. § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 C.F.R. § 1.136(a).

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS FINAL ACTION IS SET TO EXPIRE THREE MONTHS FROM THE DATE OF THIS ACTION. IN THE EVENT A FIRST RESPONSE IS FILED WITHIN TWO MONTHS OF THE MAILING DATE OF THIS FINAL ACTION AND THE ADVISORY ACTION IS NOT MAILED UNTIL AFTER THE END OF THE THREE-MONTH SHORTENED STATUTORY PERIOD, THEN THE SHORTENED STATUTORY PERIOD WILL EXPIRE

ON THE DATE THE ADVISORY ACTION IS MAILED, AND ANY EXTENSION FEE PURSUANT TO 37 C.F.R. § 1.136(a) WILL BE CALCULATED FROM THE MAILING DATE OF THE ADVISORY ACTION. IN NO EVENT WILL THE STATUTORY PERIOD FOR RESPONSE EXPIRE LATER THAN SIX MONTHS FROM THE DATE OF THIS FINAL ACTION.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Huntley whose telephone number is (703) 305-9775.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3800.

David M. Huntley

DAVID M. HUNTLEY
PRIMARY EXAMINER
GROUP 2400

dh/6-28-95